

## APPENDIX A

# JAVELIN EMPLOYMENT

*The Javelin provides accurate, medium-range antiarmor fire for the SBCT infantry company. The Javelin is used in offensive operations to provide precision, direct fires that suppress or destroy enemy armored vehicles and destroy fortifications. In defensive operations, the Javelin may be used to overwatch obstacles, destroy armored vehicles, and force the enemy commander to dismount prematurely, exposing his Infantry to small arms and indirect fires. The Javelin can destroy targets from medium ranges (65 to 2,000 meters), including helicopters and fortified positions. The SBCT infantry leader also can use the Javelin's imaging infrared (I<sup>2</sup>R) sight capability to conduct surveillance of critical avenues of approach in all types of weather. The Javelin may also be used to engage bunkers, buildings, and other fortified targets commonly found during combat in built-up areas.*

### A-1. THE JAVELIN WEAPON SYSTEM

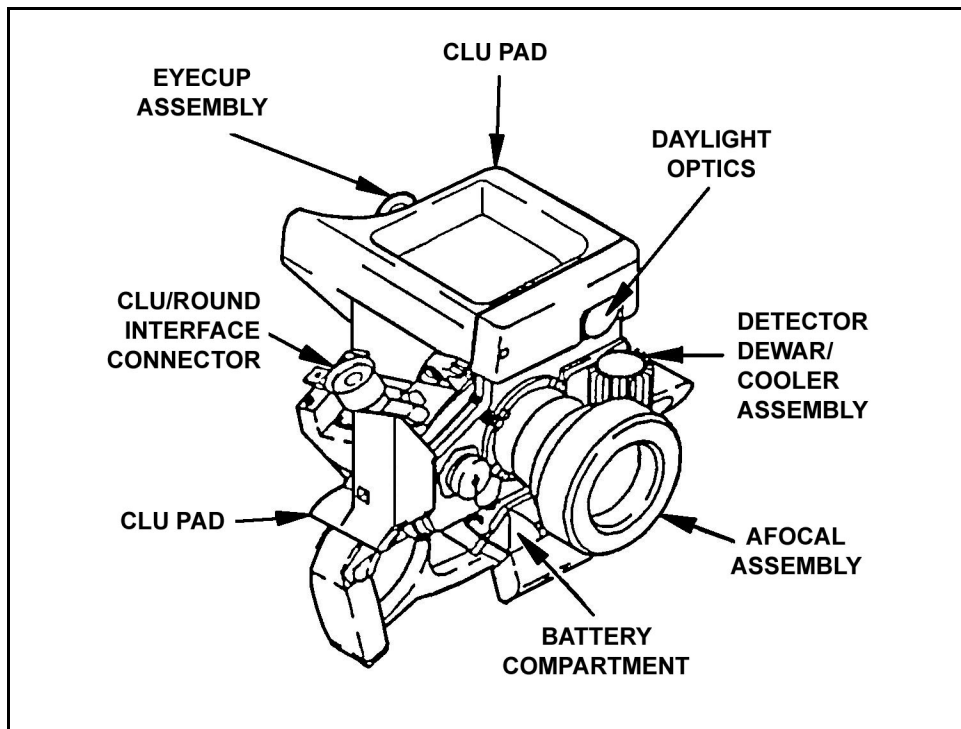
The Javelin is a dual-mode (top attack or direct attack), man-portable antitank missile with an increased capability to engage and defeat tanks and other armored vehicles (Table A-1). The Javelin has a missile contained in a disposable launch tube/container and a reusable tracker; it is a fire-and-forget weapon system. Additionally, the Javelin has a soft launch that significantly reduces the visual and acoustical signature of the missile.

Type System:	Fire and Forget
Carry Weight (Total):	49.2 lb (day & night)
Command Launch Unit:	14.1 lb (day & night)
Missile (w/launch tube):	35.2 lb
Crew:	Man portable
Ready to Fire:	Less than 30 sec.
Reload Time:	Less than 20 sec.
Method of Attack:	Top attack or direct attack (top attack is normal)
Range:	Top-attack mode: 150m-2000m Direct-attack mode: 65m-2000m
Fighting Position Restrictions:	1m x 2m, ventilation is recommended
Guidance System:	<i>Imaging Infrared or I<sup>2</sup>R</i>
Sights:	Integrated Day/Night sight unit
Time of Flight:	1,000m = approx. 4.6 sec 2,000m = approx. 14.5 sec
Sight Magnification:	4X day, 4X wide field of view and 9X narrow field of view

**Table A-1. Javelin technical characteristics.**

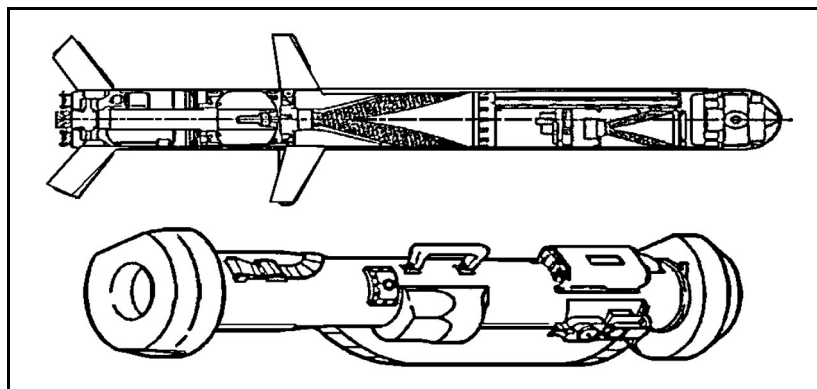
a. **Command Launch Unit.** The nondisposable section of the Javelin is the CLU (Figure A-1, page A-2). The night sight and day sight of the Javelin are integrated into one unit. The imaging infrared or I<sup>2</sup>R sight has a 2,000-meter range, under most conditions, which greatly increases target acquisition by the infantryman. The sight can

operate for over four hours on a single battery and requires no coolant bottles. It has a built-in test capability, which alerts the gunner if the system is not functioning properly during operation.



**Figure A-1. Command launch unit.**

b. **Missile.** The missile is contained in a disposable launch tube. It has a passive imaging infrared system, which locks on to the target before launch and is self-guiding. It uses a tandem shaped charge warhead and a two-stage solid propellant with a low signature, soft-launch motor, and a minimum-smoke flight motor. The launch tube assembly and missile is shown in Figure A-2.



**Figure A-2. Launch tube assembly and missile.**

## A-2. CAPABILITIES

The Javelin antitank missile has improved capabilities over the Dragon.

a. **Lethality.** The Javelin is more lethal than the Dragon. The Javelin's 2,000-meter range and its tandem warhead, which defeats all known armor, enhance the Javelin's lethality.

(1) In the top-attack mode, the missile strikes the thinner armor on the top of an armored vehicle rather than the thicker frontal and side armor plates. Top attack also prevents an enemy target from protecting itself by moving behind frontal cover. When used in urban areas or where obstacles might interfere with the top-attack flight path of the missile, the Javelin can also be fired in the direct attack mode.

(2) The fire-and-forget capability of the Javelin increases the probability of a hit. Because the gunner is no longer exposed to enemy suppressive fires while tracking the target until impact, he can use the missile's flight time to reload, in a covered and concealed position, and begin engaging another target.

b. **Survivability.** The Javelin's low launch signature decreases the enemy's ability to acquire gunners when they fire the missile. All gunner engagement tasks are accomplished before launching the missile, making time of flight irrelevant. The 2,000-meter range also places the Javelin gunner outside the armored vehicle's effective coaxial machine gun range. However, he is still within the range of the main gun.

(1) The Javelin uses a passive infrared system for target acquisition and lock-on. This means that it emits no infrared or radar beam which enemy vehicles or smart munitions can detect, further increasing the survivability of the Javelin gunner.

(2) The Javelin sight offers the SBCT infantry leader a superior observation capability as compared to the Dragon. The Javelin sight can detect targets in excess of 2,000 meters.

(3) Because of the Javelin's low backblast, it can be fired from smaller, harder to locate, better protected positions that give the gunner a greater chance of remaining undetected or, if detected, surviving any suppressive fires.

c. **Agility.** The Javelin is man-portable and relatively lightweight for an antitank missile system, which allows the system to be moved about the battlefield with relative ease. The Javelin's soft launch capability allows it to be fired from inside buildings, bunkers, and other restricted spaces with less disruption to the gunner and less signature to be observed by the enemy. Although flank shots are still the preferred method of engagement, the Javelin's low signature launch and top-attack mode make frontal and oblique engagements more effective than in the past, giving the SBCT infantry leader additional options in his antiarmor fires planning and positioning.

d. **Flexibility.** The capabilities of the Javelin give the leader more flexibility in the use and emplacement of his antiarmor systems. This new degree of flexibility challenges the leader to make a careful METT-TC analysis to ensure that he is taking full advantage of the Javelin's capabilities. The Javelin gives the leader a system that complements other antiarmor fires available, allowing him to achieve mutual support and greater overlapping fires between the systems.

### A-3. LIMITATIONS

There are certain times when the Javelin system is not able to engage targets. These occur either when a target is not exposed long enough for the missile seeker to achieve proper lock on or when atmospheric conditions interfere with the seeker.

a. **Limited Visibility.** Heavy rain, smoke, fog, snow, sleet, haze, and dust are referred to as limited visibility conditions. The presence of these conditions can affect the gunner's ability to acquire and engage targets with the Javelin, especially when using the day sight of the CLU. The gunner should use the I<sup>2</sup>R sight of the CLU to acquire targets because it provides the best target image during limited visibility conditions.

b. **Infrared Crossover.** Infrared crossover occurs at least twice in each 24-hour period when the temperatures of soil, water, concrete, and vegetation are approximately the same and the objects all emit the same amount of infrared energy. If there is little difference in the amount of infrared energy between a target and its background, then neither the Javelin CLU nor the missile seeker can see the target well, thus greatly degrading the performance of the Javelin. This situation may last as long as an hour, until either the background or the target changes temperature enough to become detectable.

c. **Time Space Factor.** Just because a target appears in the open and within range does not always mean a Javelin gunner can acquire, lock-on, fire, and hit the target. A vehicle must be exposed long enough for the gunner to identify it as a target and then to achieve target lock-on with the Javelin missile seeker. This process is not instantaneous and varies with the skill of the gunner.

### A-4. EMPLOYMENT CONSIDERATIONS

The Javelin's primary role is to destroy enemy armored vehicles. When there is not an armored threat, the Javelin can be employed in a secondary role of providing fire support against point targets such as bunkers and crew-served weapons positions. In addition, the Javelin's CLU can be used alone as an aided vision device for reconnaissance, security operations, and surveillance.

a. **Mutual Support.** Javelins should be positioned so they can support other Javelins as firing pairs (Figure A-3). In terrain that has multiple narrow avenues of approach, the Javelin may be employed as a single weapon system. In open terrain, Javelins should be positioned to achieve overlapping sectors (Figure A-4). Mutual support prevents the enemy from isolating a portion of the friendly unit and then concentrating on one sector without being subjected to fire from another. If mutual support is achieved, when one Javelin is destroyed or forced to displace, the others can continue covering the assigned sector. As a rule of thumb, gunners should normally be positioned far enough apart so enemy fires directed at one cannot suppress others.

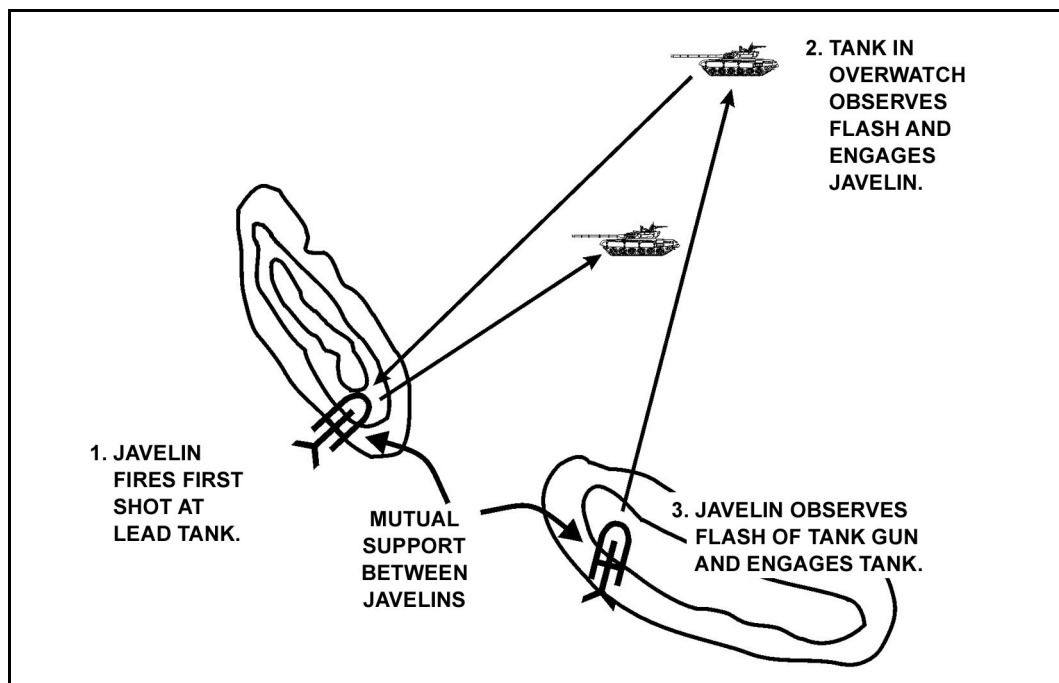


Figure A-3. Employment by firing pair.

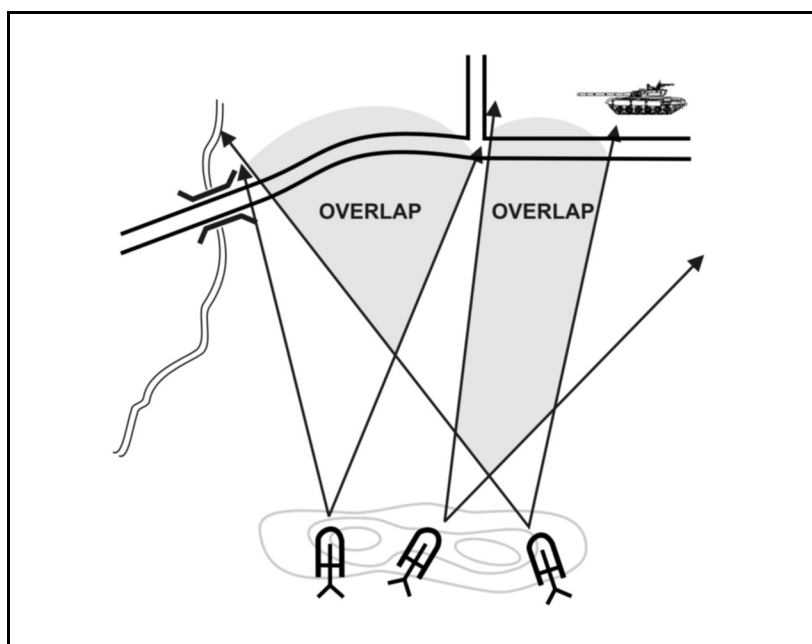


Figure A-4. Overlapping sectors of fire.

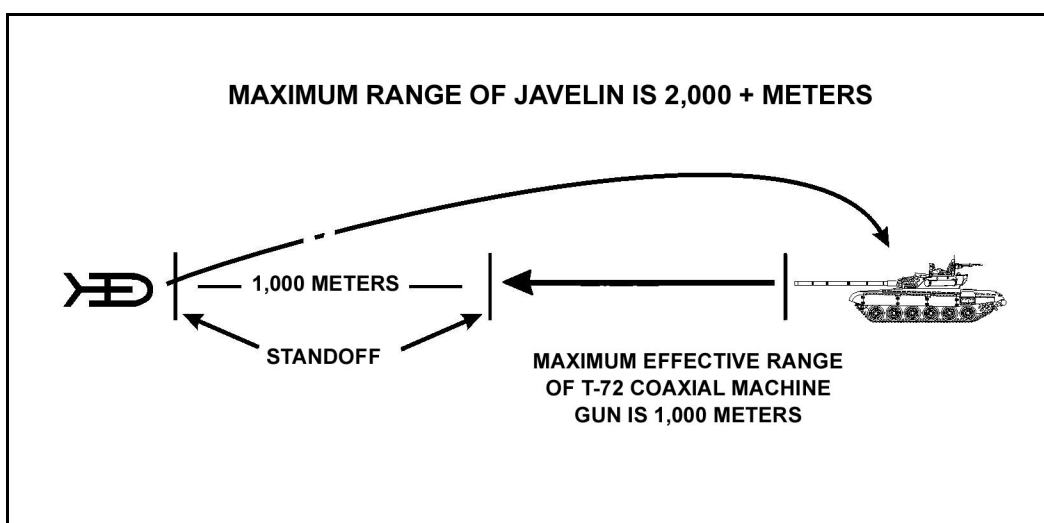
b. **Flank Shot Engagements.** Leaders should position Javelins to engage from the flank whenever possible because:

- Armored vehicles are most vulnerable from the flank.
- The focus of the crew will normally be to the front and not to the flank.
- Armored vehicles present the largest visual and infrared target from the flank.

- The vehicle's various sighting systems, laser range finder, and firepower are normally oriented to the front, not the flank.
- Armored vehicles have less armor on the sides than on the front. This is important when engaging in the direct-fire mode.

c. **Javelin Standoff Advantage.** The difference between the Javelin's maximum range and the maximum effective range of the enemy tank's coaxial machine gun (Figure A-5) creates an advantage in a standoff. The Javelin's maximum range is 2,000 meters. The maximum effective range of a T-72 coaxial machine gun is 1,000 meters. The Javelin gunner should strive to engage enemy tanks in the 1,000- to 2,000-meter range.

**NOTE:** Most modern tanks, as well as infantry fighting vehicles, can fire high-explosive ammunition to suppress gunners out to 4,000 meters.



**Figure A-5. Standoff range.**

d. **Cover and Concealment.** Cover and concealment are critical to the survival of an antiarmor weapon system and its crew. The SBCT leader responsible for Javelin employment must analyze cover and concealment along with fields of fire and observation.

(1) **Cover.** Cover is protection from enemy weapons fire and may be natural or man-made. Natural cover includes reverse slopes, ravines, and hollows. Man-made cover includes fighting positions, walls, rubble, and craters.

(2) **Concealment.** Concealment is the ability to hide from enemy observation. Soldiers should avoid unnecessary movement, stay low and observe, and present themselves and their equipment using the lowest silhouette possible. They should alter familiar shapes by breaking up the common outlines of the position and equipment using vegetation and camouflage netting. They must pay attention to the varied colors and textures of the area to ensure the position blends in with its background. Additionally, noises, such as engines running, talking, and moving equipment, can be heard by enemy patrols and observation posts. Shiny surfaces can reflect light for great distances; therefore they must not expose anything that shines.

e. **Soldier's Load.** When employing the Javelin in the dismounted role, the soldier's load becomes important. With a total system weight of just under 50 pounds, the Javelin is heavy. Although a man-portable weapon, one soldier cannot easily carry the Javelin cross-country for extended periods. Leaders should be aware of this problem and address it as they would any other soldier's load difficulty. FM 21-18 discusses soldier's load and cross-leveling equipment during movement to reduce the burden on soldiers. Leaders should develop unit SOPs that identify and describe the details of unit equipment cross leveling.

f. **Massed Fires.** Massed fires are achieved by coordinating the total effects of the unit's combat power at the decisive place and time to gain favorable results against the enemy. The unit achieves mass through mutual fire support, detailed fire control, and fire distribution measures that synchronize all of the fires of the SBCT company's weapons systems and elements. The Javelin should always be positioned so that its fires are part of a cohesive combination including small arms, MGS, mortar and artillery, as well as the close-in fires of the SBCT platoons using their AT-4 light antiarmor weapons.

#### A-5. JAVELIN EMPLOYMENT DURING URBAN COMBAT

Javelins provide overwatching antitank fires during the attack of a built-up area and an extended range capability for the engagement of armor during the defense. Within built-up areas, they are best employed along major thoroughfares and from the upper stories of buildings to attain long-range fields of fire. The missile's minimum arming range and flight profile could limit firing opportunities in the confines of densely built-up areas.

a. **Restrictions.** Ground obstacles and water do not restrict the Javelin with its fire-and-forget capability. However, with its unique flight characteristics, overhead obstacles can limit its use in urban terrain. In the top-attack mode, the Javelin missile requires up to 160-plus meters of overhead clearance (Figure A-6). In the direct-attack mode, the Javelin requires up to 60-plus meters of overhead clearance (Figure A-7, page A-8). Gunners must ensure that sufficient overhead clearance is available along the missile flight path before engaging targets in an urban environment.

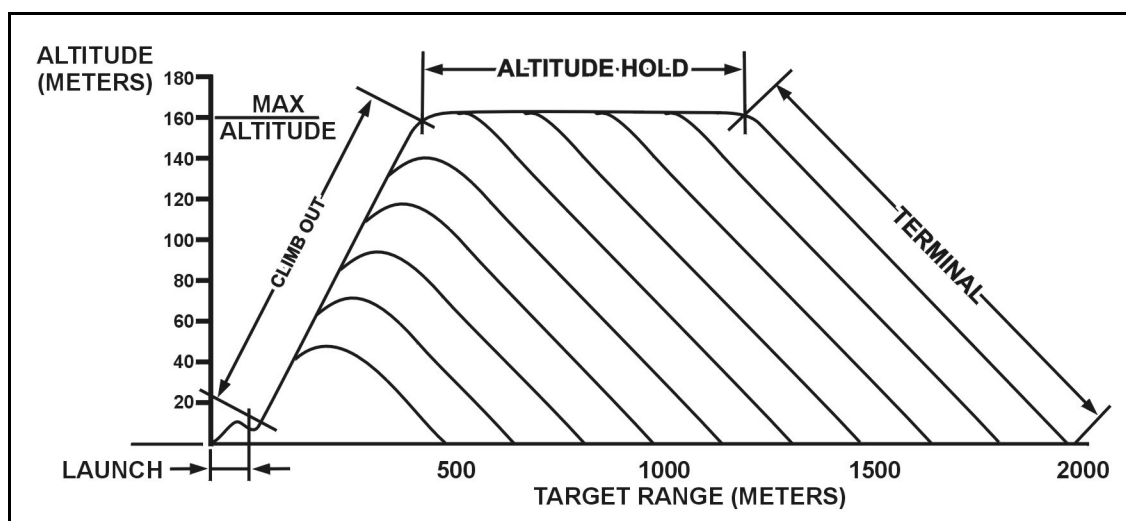
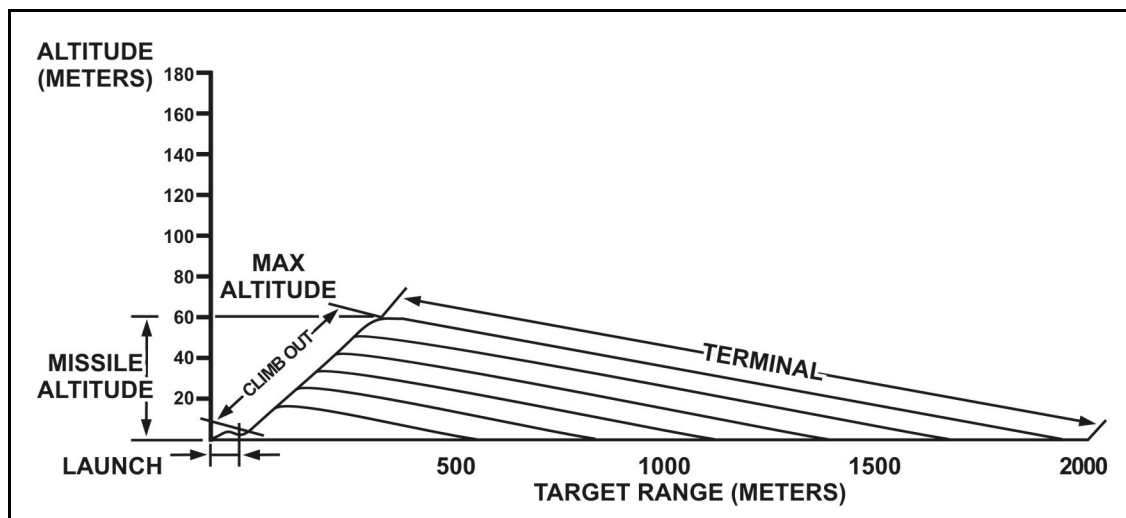


Figure A-6. Javelin flight profile in top-attack mode.



**Figure A-7. Javelin flight profile in direct-attack mode.**

b. **Dead Space.** The aspects of dead space that affect Javelin fires the most are arming distance and target and background temperature differences.

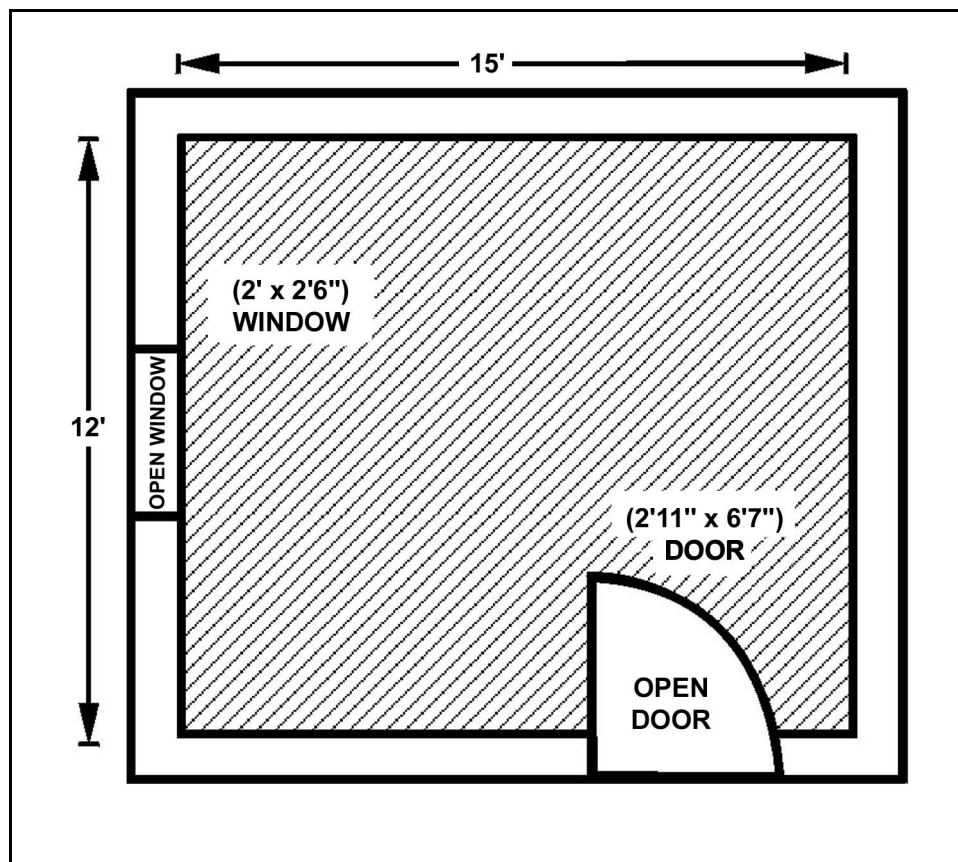
(1) The Javelin missile has a minimum arming window of 65 to 75 meters. Few areas in the inner city permit fires much beyond the minimum arming distance. Ground-level long-range fires down streets or rail lines and across parks or plazas are possible. The Javelin may be used effectively from the upper stories or roofs of buildings to fire into other buildings.

(2) The Javelin gunner must take into consideration the targeting dead space that is sometimes caused by the background of the target and its heat signature. When firing from the upper stories of a building towards the ground, the missile seeker sometimes cannot discriminate between the target and surrounding rubble, buildings, or paving if that background material has the same temperature as the target.

c. **Backblast.** The Javelin's soft launch capability enables the gunner to fire from within an enclosed area (Figure A-8) with a reduced danger from backblast overpressure or flying debris. Personnel within the enclosure should still wear a helmet, protective vest, ballistic eye protection, and hearing protection. To fire a Javelin from inside a room, the following safety precautions must be taken:

- Ceiling height must be at least 7 feet.
- The floor size of the room should be at least 15 feet by 12 feet.
- Window opening must be at least 5 square feet
- Door opening must be at least 20 square feet
- When launching a missile from an enclosure, allow sufficient room for the missile container to extend beyond the outermost edge of the enclosure.
- All personnel in the room must be forward of the rear of the weapon.





**Figure A-8. Minimum room enclosure for Javelin firing.**

d. **Weapon Penetration.** The warhead of the Javelin can achieve significant penetration against typical urban targets. Penetration, however, does not mean a concurrent destruction of the structural integrity of a position. When engaging a position in a building, use the direct-attack mode to hit the target. When engaging a position or bunker in the open, use either the top-attack or direct-attack mode.

#### **A-6. JAVELIN FIRING POSITIONS**

Each Javelin should have a primary firing position and at least one alternate position. Depending on the factors of METT-TC, a supplementary position may also be assigned. A Javelin firing position must allow for target engagement and provide protection for the soldiers and the weapon system. When selecting firing positions, leaders should consider the following:

- Cover to the front, flank, and overhead.
- Concealment from ground and aerial observation.
- Good observation and fields of fire.
- Covered and concealed routes to and between positions.
- Mutual support between squad positions and with other elements.
- Position below ridgelines and crests, preferably on the sides of hills.
- Avoid positions in swampy areas and very steep hillsides, as well as positions on or near prominent terrain features.

**A-7. DETECT, CLASSIFY AND RECOGNIZE**

US forces must engage targets quickly and efficiently to win in combat. Speed of target engagement depends on each Javelin gunner's proficiency in acquiring targets, identifying targets, and determining whether targets can be engaged. Dust and smoke make locating and identifying the enemy difficult. As the battle progresses and friendly and enemy units merge into the same maneuver area, acquiring and identifying targets become crucial tasks. Gunners in the company should be trained to acquire enemy targets that are camouflaged or partially concealed by terrain, vegetation, or smoke. They should also be trained to identify targets as friend or foe. Once soldiers know where to look, they must know how to detect enemy targets rapidly.

a. **Primary Analysis.** Because the Javelin's primary targets are armored vehicles, specifically tanks, gunners should look for terrain where these targets are most likely to appear. Understanding armor tactics and the characteristics of armor vehicles can help Javelin gunners recognize the terrain where these vehicles are most likely to be employed.

(1) **Enemy Analysis.** The tactics of many potential adversaries stress using speed and massive firepower to overwhelm and destroy an opposing force. This dictates a very high average daily rate of advance. To move consistently at a high rate, armored forces require firm ground to move rapidly and enough space to deploy, maneuver, and fire. High-speed avenues of approach, such as road networks, broad ridges, and flat or rolling terrain, should be observed constantly.

(2) **Terrain and Weather Analysis.** A detailed analysis of the terrain and weather is useful in pinpointing armored or mechanized avenues of approach and to evaluate them from the enemy's viewpoint. Some questions that the leader should ask are "How can the enemy use this terrain?" and "Where is he most likely to appear first?" Because weather significantly affects the trafficability of terrain, a ground reconnaissance is needed to obtain current, detailed information about roads, trails, manmade objects, density of trees and brush, and the seasonal conditions of streams and rivers. If a ground reconnaissance is not possible, an aerial reconnaissance should be conducted or recent aerial photographs should be used.

(3) **Armored and Mechanized Vehicles' Mobility Characteristics.** Javelin gunners can more easily determine where to look for enemy armored vehicles if they know the vehicles' mobility characteristics. If possible, tank and motorized rifle units will avoid terrain or obstacles that can stop or impede their movement. Terrain factors that restrict armored or mechanized vehicle mobility include:

- Slopes steeper than 30 degrees.
- Sturdy walls or embankments 3 or more feet high.
- Ditches or gullies 9 or more feet wide and 3 or more feet deep.
- Hardwood trees 10 inches or larger in diameter and 10 feet or less apart.
- Water obstacles at least 5 feet deep.
- Very swampy or very rough, rocky terrain.
- Built-up areas where vehicles are restricted to moving on confined roads, through park areas, or across sports fields.

b. **Range Estimation.** Javelin gunners do not need to know the exact range to a enemy target before engaging; they only need to know when it is in range. To speed this determination, gunners use a maximum engagement line. A Javelin maximum

engagement line is an imaginary line drawn across a sector's maximum allowable range from a Javelin firing position. To determine the location of this line on the ground, the SBCT company leadership identifies terrain features at or near maximum range. Therefore, any target that crosses or appears short of this line should be within range. Establishing a maximum engagement line greatly reduces target engagement times, especially for targets that seem to be near maximum range. Several range-determination techniques can be used to find the maximum range line or the range to specific targets.

(1) **Laser Range-Finding Method.** Most units and all FIST teams should have laser range-finders. The range from the Javelin position to an easily identifiable terrain feature can be easily determined with the laser range-finder. Once the maximum engagement line is determined, the gunner makes a note of a terrain feature at that location on his range card. Any vehicle nearing that feature will be in range.

(2) **Object Recognition Method.** Range determination by object recognition is simple and can be accurate with training. The soldier looks at the target with his naked eye, sights through 7X binoculars, or uses a Javelin optical sight. Targets listed in Table A-2 are recognizable out to the ranges indicated--for example, if a target can be recognized with the naked eye as an armored or wheeled vehicle, it is probably within 2,000 meters. When using this method, the gunner must consider terrain, visibility conditions, and target size.

TARGETS	RANGE (meters)	
	NAKED EYE	7X SCOPE
Tank crew members	500	2,000
Soldiers, machine gun, mortar	500	2,000
Antitank gun, antitank missile launchers	500	2,000
Tank, APC, truck (by model)	1,000	4,000
Tank, Howitzer, APC, truck	1,500	5,000
Armored vehicle, wheeled vehicle	2,000	6,000

**Table A-2. Range determination recognition method.**

(3) **Map and Terrain Association Method.** The maximum engagement line can be determined from a map. Do this for each firing position as follows:

- Draw an arc on the map across the assigned sector of fire at 2,000 meters.
- Examine the map to identify the distinctive natural or man-made terrain features that the line touches.
- Study the terrain in the sector of fire using binoculars or the Javelin CLU until all the selected terrain features are located and positively identified.
- Connect these features by an imaginary line from the maximum engagement line.

**A-8. PRINCIPLES OF FIRE CONTROL**

Effective fire control requires the SBCT company to rapidly acquire the enemy and mass the effects of fire in order to achieve decisive results. The following principles are fundamental to achieving effective fires. When planning and executing direct fires, the SBCT leadership should apply the following principles of fire control:

- Mass the effects of fire.
- Destroy the greatest threat first.
- Avoid target overkill.
- Employ the best weapon for the target.
- Minimize friendly exposure.
- Minimize the chances for fratricide.

**A-9. FIRE CONTROL MEASURES**

Fire control measures must enable Javelin gunners to distribute or mass fires effectively into a given area and over time. Fire control measures are the means by which the SBCT company commander and his subordinate leaders control fires. Application of these concepts, procedures, and techniques assists the unit in acquiring the enemy, focusing fires on him, distributing the effects of the fires, effectively shifting fires, and preventing fratricide. At the same time, no single measure is sufficient to effectively control fires. At the SBCT company level, fire control measures will be effective only if the entire company has a common understanding of what the fire control measures mean and how to employ them. When executing direct fires, the SBCT company commander and his subordinate leaders should apply these methods of fire control:

- Distribution of fires over a given area.
- Massing of fires into a given area.
- Distribution of fires over time.
- Massing of fires in time and space.
- Target reference points.
- Trigger lines and phase lines.
- Engagement priorities.

**A-10. SELF-DEFENSE AGAINST HELICOPTERS**

Because Javelin positions are selected to cover enemy armor avenues of approach, the medium-range fields of fire afforded by these positions also enable Javelin gunners to engage aircraft.

a. **Weapons Control Status.** The weapons control status established for air defense weapons applies to Javelin gunners too. Unless ordered otherwise, gunners should only fire in unit self-defense (for example, only engage aircraft that are attacking friendly positions).

b. **Self Defense Engagements.** A Javelin gunner can automatically engage an enemy helicopter that is attacking its position. The gunner's target engagement sequence is the same as against ground targets. The Javelin should be in the direct-fire mode when engaging helicopters. The rotors of the helicopter may interfere with the sensors of the missile in the top-attack mode and result in erratic flight of the missile and a target miss.